# Chapter 15: Noise

## A. INTRODUCTION

The proposed Lambert Houses project would not generate sufficient traffic to have the potential to cause a significant noise impact (i.e., it would not result in a doubling of Noise passenger car equivalents [Noise PCEs] which would be necessary to cause a 3 dBA increase in noise levels). However, ambient noise levels adjacent to the Development Site were considered in order to address the level of building attenuation necessary to ensure that the proposed project's interior noise levels satisfy applicable interior noise criteria. This potential is assessed below.

## B. ACOUSTICAL FUNDAMENTALS

Sound is a fluctuation in air pressure. Sound pressure levels are measured in units called "decibels" ("dB"). The particular character of the sound that we hear (a whistle compared with a French horn, for example) is determined by the speed, or "frequency," at which the air pressure fluctuates, or "oscillates." Frequency defines the oscillation of sound pressure in terms of cycles per second. One cycle per second is known as 1 Hertz ("Hz"). People can hear over a relatively limited range of sound frequencies, generally between 20 Hz and 20,000 Hz, and the human ear does not perceive all frequencies equally well. High frequencies (e.g., a whistle) are more easily discernable and therefore more intrusive than many of the lower frequencies (e.g., the lower notes on the French horn).

### "A"-WEIGHTED SOUND LEVEL (DBA)

In order to establish a uniform noise measurement that simulates people's perception of loudness and annoyance, the decibel measurement is weighted to account for those frequencies most audible to the human ear. This is known as the A-weighted sound level, or "dBA," and it is the descriptor of noise levels most often used for community noise. As shown in **Table 15-1**, the threshold of human hearing is defined as 0 dBA; very quiet conditions (as in a library, for example) are approximately 40 dBA; levels between 50 dBA and 70 dBA define the range of noise levels generated by normal daily activity; levels above 70 dBA would be considered noisy, and then loud, intrusive, and deafening as the scale approaches 130 dBA.

In considering these values, it is important to note that the dBA scale is logarithmic, meaning that each increase of 10 dBA describes a doubling of perceived loudness. Thus, the background noise in an office, at 50 dBA, is perceived as twice as loud as a library at 40 dBA. For most people to perceive an increase in noise, it must be at least 3 dBA. At 5 dBA, the change will be readily noticeable.

**Table 15-1**
**Common Noise Levels**

| Sound Source | (dBA) |
|---|---|
| Military jet, air raid siren | 130 |
| Amplified rock music | 110 |
| Jet takeoff at 500 meters | 100 |
| Freight train at 30 meters | 95 |
| Train horn at 30 meters | 90 |
| Heavy truck at 15 meters | 80–90 |
| Busy city street, loud shout | 80 |
| Busy traffic intersection | 70–80 |
| Highway traffic at 15 meters, train | 70 |
| Predominantly industrial area | 60 |
| Light car traffic at 15 meters, city or commercial areas, or residential areas close to industry | 50–60 |
| Background noise in an office | 50 |
| Suburban areas with medium-density transportation | 40–50 |
| Public library | 40 |
| Soft whisper at 5 meters | 30 |
| Threshold of hearing | 0 |

**Note:** A 10 dBA increase in level appears to double the loudness, and a 10 dBA decrease halves the apparent loudness.
**Sources:** Cowan, James P. *Handbook of Environmental Acoustics,* Van Nostrand Reinhold, New York, 1994. Egan, M. David, Architectural Acoustics. McGraw-Hill Book Company, 1988.

## SOUND LEVEL DESCRIPTORS

Because the sound pressure level unit of dBA describes a noise level at just one moment and very few noises are constant, other ways of describing noise that fluctuates over extended periods have been developed. One way is to describe the fluctuating sound heard over a specific time period as if it had been a steady, unchanging sound. For this condition, a descriptor called the "equivalent sound level," $L_{eq}$, can be computed. $L_{eq}$ is the constant sound level that, in a given situation and time period (e.g., 1 hour, denoted by $L_{eq(1)}$, or 24 hours, denoted by $L_{eq(24)}$), conveys the same sound energy as the actual time-varying sound. Statistical sound level descriptors such as $L_1$, $L_{10}$, $L_{50}$, $L_{90}$, and $L_x$, are used to indicate noise levels that are exceeded 1, 10, 50, 90, and x percent of the time, respectively.

The relationship between $L_{eq}$ and levels of exceedance is worth noting. Because $L_{eq}$ is defined in energy rather than straight numerical terms, it is not simply related to the levels of exceedance. If the noise fluctuates very little, $L_{eq}$ will approximate $L_{50}$ or the median level. If the noise fluctuates broadly, the $L_{eq}$ will be approximately equal to the $L_{10}$ value. If extreme fluctuations are present, the $L_{eq}$ will exceed $L_{90}$ or the background level by 10 or more decibels. Thus the relationship between $L_{eq}$ and the levels of exceedance will depend on the character of the noise. In community noise measurements, it has been observed that the $L_{eq}$ is generally between $L_{10}$ and $L_{50}$.

The 1-hour $L_{10}$ is the noise descriptor used in the *CEQR Technical Manual* noise exposure guidelines for City environmental impact review classification.

# C. NOISE STANDARDS AND CRITERIA

## NEW YORK CEQR NOISE CRITERIA

The *CEQR Technical Manual* defines attenuation requirements for buildings based on exterior noise level (see **Table 15-2**, "Required Attenuation Values to Achieve Acceptable Interior Noise Levels"). Recommended noise attenuation values for buildings are designed to maintain interior noise levels of 45 dBA or lower for residential uses and interior noise levels of 50 dBA or lower for commercial uses and are determined based on exterior $L_{10(1)}$ noise levels.

**Table 15-2**
**Required Attenuation Values to Achieve Acceptable Interior Noise Levels**

| | Marginally Unacceptable | | | | Clearly Unacceptable |
|---|---|---|---|---|---|
| Noise Level With Proposed Action | $70 < L_{10} \leq 73$ | $73 < L_{10} \leq 76$ | $76 < L_{10} \leq 78$ | $78 < L_{10} \leq 80$ | $80 < L_{10}$ |
| Attenuation[A] | (I) 28 dB(A) | (II) 31 dB(A) | (III) 33 dB(A) | (IV) 35 dB(A) | $36 + (L_{10} - 80)$[B] dB(A) |

**Notes:**
[A] The above composite window-wall attenuation values are residential development. Commercial uses would be 5 dB(A) less in each category. All the above categories require a closed window situation and hence an alternate means of ventilation.
[B] Required attenuation values increase by 1 dB(A) increments for $L_{10}$ values greater than 80 dBA.
**Source:** New York City Department of Environmental Protection.

## HUD DEVELOPMENT GUIDELINES

The *HUD Noise Guidebook* sets exterior noise standards for housing construction projects based on calculated $L_{dn}$ values (see **Table 15-3**). The $L_{dn}$ refers to a 24-hour average noise level with a 10 dB penalty applied to the noise levels during the hours between 10 PM and 7 AM, due to increased sensitivity to noise levels during these hours. If the exterior noise level is 65 $L_{dn}$ to 70 $L_{dn}$, 25 dBA of noise attenuation must be provided; if the exterior noise level is 70 $L_{dn}$ to 75 $L_{dn}$, 30 dBA of noise attenuation is required; and if the exterior noise level exceeds 75 $L_{dn}$, sufficient attenuation must be provided to bring interior levels down to 45 $L_{dn}$ or lower for residential uses.

**Table 15-3**
**HUD Exterior Noise Standards**

| | Acceptable | Normally Unacceptable | Unacceptable |
|---|---|---|---|
| Noise Level With Proposed Actions | $L_{dn} \leq 65$ | $65 < L_{dn} \leq 75$ | $75 < L_{dn}$ |
| **Source:** U.S. Department of Housing and Urban Development | | | |

For this analysis, $L_{dn}$ levels were calculated using the following equation:

$$L_{dn} = 10\lg\left[(3)10^{L_{eq}(peakhour)-2/10} + (12)10^{L_{eq}(midday)-2/10} + (9)10^{L_{eq}(latenight)+8/10}\right] - 13.8$$

The method to determine $L_{dn}$ values is to measure hourly $L_{eq}$'s for three typical hours of the day and then to compute the $L_{dn}$ from these three hourly $L_{eq}$'s.

# D. EXISTING NOISE LEVELS

## NOISE MONITORING LOCATIONS

Existing noise levels at the proposed project site were measured at six (6) locations (receptor sites). Site 1 was located on Bronx Park South between Boston Road and Bryant Avenue, Site 2 was located on 180th Street between Boston Road and Vyse Avenue, Site 3 was located on Boston Road between 179th Street and 180th Street, Site 4 was located on 179th Street between Boston Road and Vyse Avenue, Site 5 was located on Tremont Avenue between Boston Road and Devoe Avenue, and Site A was located on the roof of the parking garage at Boston Road and 179th Street (see **Figure 15-1**).

At all receptor sites, existing noise levels were measured for 20-minute periods during three weekday peak periods—AM (7:30 AM to 9:30 AM), midday (MD) (12:00 PM to 2:00 PM), and PM (4:30 PM to 6:30 PM). Measurements were taken on June 25, 2013.

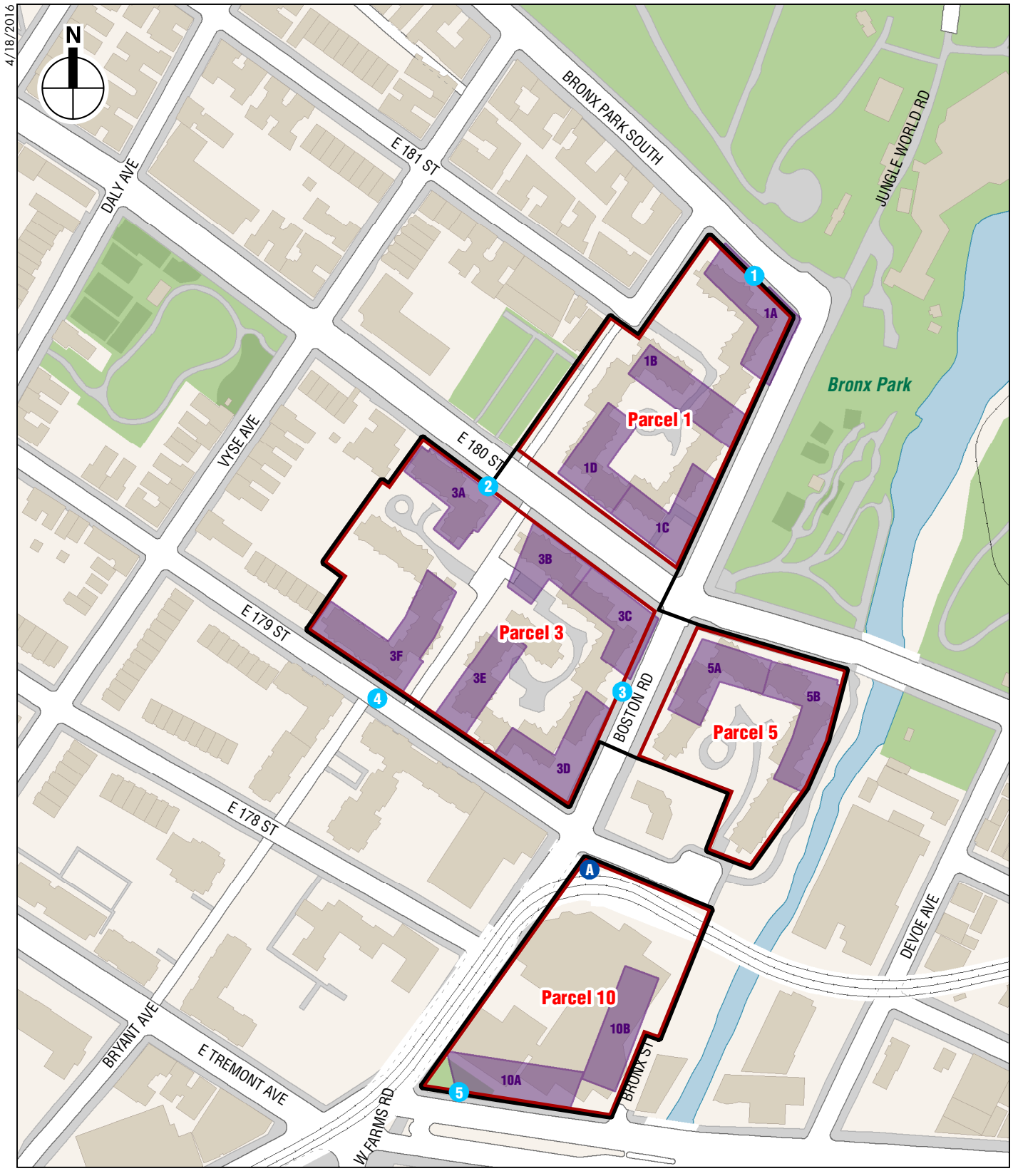
## EQUIPMENT USED DURING NOISE MONITORING

Measurements were performed using Brüel & Kjær Sound Level Meters (SLMs) Type 2260, Brüel & Kjær ½-inch microphones Type 4189, and Brüel & Kjær Sound Level Calibrators Type 4231. The SLMs have laboratory calibration date within one year of use. The Brüel & Kjær SLM is a Type 1 instrument according to ANSI Standard S1.4-1983 (R2006). For receptor sites 1, 2, 3, 4, 5, and A, the microphone was mounted on a tripod at a height of approximately 5 feet above the ground and was mounted at least approximately 5 feet away from any large reflecting surfaces. The SLMs were calibrated before and after readings with a Brüel & Kjær Type 4231 Sound Level Calibrator using the appropriate adaptor. Measurements at each location were made on the A-scale (dBA). The data were digitally recorded by the sound level meter and displayed at the end of the measurement period in units of dBA. Measured quantities included $L_{eq}$, $L_1$, $L_{10}$, $L_{50}$, $L_{90}$, and 1/3 octave band levels. A windscreen was used during all sound measurements except for calibration. All measurement procedures were based on the guidelines outlined in ANSI Standard S1.13-2005.

## NOISE MEASUREMENT RESULTS

The results of the existing noise level measurements are summarized in **Table 15-4**.

At receptor sites 1 through 5, vehicular traffic was the dominant noise source. Measured levels are moderate to relatively high and reflect the level of vehicular activity on the adjacent roadways. At receptor site A, rail noise from the elevated MTA #2 and #5 trains was the dominant noise source. Measured levels were high to very high and reflect the level of rail activity on the elevated rail line. Vehicular traffic from adjacent streets was also included in the measurement but was not considered a dominant source. In terms of the CEQR criteria, the existing noise levels at receptor site 1 would be in the "marginally acceptable" category, existing levels at receptor sites 2, 3, 4, and 5 would be in the "marginally unacceptable" category, and existing levels at receptor site A would be in the "clearly unacceptable" category. In terms of the HUD criteria, the calculated $L_{dn}$ noise levels at sites 1 through 5 would be in the "normally unacceptable" category, and the calculated $L_{dn}$ noise levels at site A would be in the "unacceptable" category.

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Noise Receptor Locations

**Figure 15-1**

**Table 15-4**
**Existing Noise Levels (in dBA)**

| Site | Measurement Location (Receptor Site) | Time | $L_{eq}$ | $L_1$ | $L_{10}$ | $L_{50}$ | $L_{90}$ | $L_{dn}$ |
|---|---|---|---|---|---|---|---|---|
| 1 | Bronx Park South between Boston Road and Bryant Avenue | AM | 65.3 | 76.2 | 67.9 | 61.4 | 57.0 | 66.1 |
| | | MD | 66.2 | 77.1 | 68.1 | 62.4 | 59.7 | |
| | | PM | 63.8 | 73.5 | 66.5 | 61.0 | 58.1 | |
| | | LN | 60.2 | 67.2 | 63.4 | 58.3 | 57.2 | |
| 2 | 180th Street between Boston Road and Vyse Avenue | AM | 70.9 | 79.7 | 75.0 | 67.1 | 61.1 | 71.3 |
| | | MD | 70.0 | 81.4 | 72.6 | 65.8 | 60.9 | |
| | | PM | 69.2 | 79.3 | 72.0 | 64.8 | 60.8 | |
| | | LN | 65.9 | 77.5 | 68.0 | 60.3 | 57.4 | |
| 3 | Boston Road between 179th Street and 180th Street | AM | 70.3 | 80.4 | 74.2 | 65.6 | 59.5 | 72.3 |
| | | MD | 70.4 | 82.3 | 73.0 | 64.8 | 59.2 | |
| | | PM | 69.9 | 80.2 | 73.0 | 64.8 | 60.5 | |
| | | LN | 67.3 | 76.8 | 71.1 | 60.6 | 56.5 | |
| 4 | 179th Street between Boston Road and Vyse Avenue | AM | 67.9 | 78.2 | 71.1 | 61.2 | 58.8 | 69.8 |
| | | MD | 64.1 | 71.8 | 67.9 | 60.4 | 58.5 | |
| | | PM | 64.4 | 73.2 | 68.5 | 60.8 | 59.1 | |
| | | LN | 65.4 | 76.3 | 68.6 | 59.5 | 58.0 | |
| 5 | Tremont Avenue between Boston Road and Devoe Avenue | AM | 74.1 | 82.4 | 78.0 | 71.3 | 68.3 | 75.0 |
| | | MD | 74.3 | 80.5 | 77.7 | 72.6 | 68.5 | |
| | | PM | 74.9 | 82.3 | 78.5 | 72.7 | 67.9 | |
| | | LN | 69.4 | 79.5 | 73.4 | 64.5 | 59.2 | |
| A | Boston Road and 179th Street (Roof of Parking Garage) | AM | 82.6 | 92.9 | 88.4 | 69.6 | 66.4 | 83.6 |
| | | MD | 81.8 | 91.4 | 87.8 | 69.1 | 67.6 | |
| | | PM | 81.0 | 91.8 | 86.0 | 68.5 | 67.0 | |
| | | LN | 78.5 | 91.1 | 80.9 | 66.9 | 64.9 | |

**Note:** Measurements were conducted by AKRF Acoustics Department on June 25 and 26, 2013.

## E. NOISE ATTENUATION MEASURES

As shown in **Table 15-2**, the *CEQR Technical Manual* has set noise attenuation quantities for buildings based on exterior $L_{10(1)}$ noise levels in order to maintain interior noise levels of 45 dBA or lower for residential uses and interior noise levels of 50 dBA or lower for commercial uses. As shown in **Table 15-2, t**he *HUD Noise Guidebook* recommends that buildings should provide sufficient window/wall attenuation to result in $L_{dn}$ values of 45 dBA or less for residential uses. The results of the building attenuation analysis are summarized in **Table 15-5**.

The attenuation of a composite structure is a function of the attenuation provided by each of its component parts and how much of the area is made up of each part. Normally, a building façade consists of wall, glazing, and any vents or louvers associated with the building mechanical systems in various ratios of area. The proposed building's façades, including these elements, would be designed to provide a composite Outdoor-Indoor Transmission Class[1] (OITC) rating greater than or equal to the attenuation requirements listed in **Table 15-5**.

Based upon the measured $L_{10(1)}$ and calculated $L_{dn}$ values at the project site, the proposed project's design measures would be expected to provide sufficient attenuation to achieve both the CEQR and the HUD interior noise level requirements.

[1] The OITC classification is defined by ASTM International (ASTM E1332-10a) and provides a single-number rating that is used for designing a building façade including walls, doors, glazing, and combinations thereof. The OITC rating is designed to evaluate building elements by their ability to reduce the overall loudness of ground and air transportation noise.

**Table 15-5**
**Building Attenuation Requirements**

| Parcel # | Building | Facade | Measurement Location | Maximum Predicted $L_{10}$ (in dBA) | CEQR Attenuation Required (in dBA)[1] | Maximum Calculated $L_{dn}$ (in dBA) | HUD Attenuation Required (in dBA)[3] | Attenuation Required (in dBA)[4] |
|---|---|---|---|---|---|---|---|---|
| 1 | 1A | All | 1 | 68.1 | N/A[2] | 66.1 | 22 | 22 |
| | 1B | All | 1 | 68.1 | N/A[2] | 66.1 | 22 | 22 |
| | 1C | All | 1 | 68.1 | N/A[2] | 66.1 | 22 | 22 |
| | 1D | South, East | 2 | 75.0 | 31 | 71.3 | 27 | 31 |
| | | North, West | 3 | 74.2 | 31 | 72.3 | 28 | 31 |
| 3 | 3A | All | 2 | 75.0 | 31 | 71.3 | 27 | 31 |
| | 3B | All | 2 | 75.0 | 31 | 71.3 | 27 | 31 |
| | 3C | North, West | 2 | 75.0 | 31 | 71.3 | 27 | 31 |
| | | East, South | 3 | 74.2 | 31 | 72.3 | 28 | 31 |
| | 3D | East, North | 3 | 74.2 | 31 | 72.3 | 28 | 31 |
| | | West, South | 4 | 71.1 | 28 | 69.8 | 25 | 28 |
| | 3E | All | 4 | 71.1 | 28 | 69.8 | 25 | 28 |
| | 3F | All | 4 | 71.1 | 28 | 69.8 | 25 | 28 |
| 5 | 5A | West, South, East | 3 | 74.2 | 31 | 72.3 | 28 | 31 |
| | | North | 2 | 75.0 | 31 | 71.3 | 27 | 31 |
| | 5B | All | 2 | 75.0 | 31 | 71.3 | 27 | 31 |
| 10 | 10A | North, West | A | 88.4 | 45 | 83.6 | 39 | 45 |
| | | East, South | 5 | 78.5 | 35 | 75.0 | 30 | 35 |
| 10 | School | North, West | A | 88.4 | 45 | 83.6 | 39 | 45 |
| | | East, South | 5 | 78.5 | 35 | 75.0 | 30 | 35 |

**Notes:**
(1) The above composite window-wall attenuation values are for residential development. Commercial uses would be 5 dB(A) less.
(2) "N/A" indicates that the $L_{10}$ value is less than 70 dB(A). The *CEQR Technical Manual* does not address noise levels this low, therefore there is no minimum attenuation guidance.
(3) The HUD attenuations apply to residential uses only.
(4) Window/wall attenuations required to satisfy both CEQR and HUD requirements, where applicable and conservative.

In order to ensure that the proposed project would achieve the necessary building attenuation requirements, "E" designations would be mapped for each development site included in the proposed project. The text for the Noise "E" designations is as follows:

*"In order to ensure an acceptable interior noise environment, future residential/classroom uses must provide a closed window condition in order to maintain an interior noise level of 45 dBA. Retail, commercial and administrative uses must provide a closed window condition in order to maintain an interior noise level of 50 dBA. In order to maintain a closed window condition, an alternate means of ventilation that brings outside air into the building must also be provided. Alternate means of ventilation includes, but is not limited to, central air conditioning, PTAC units with a user-operable air damper, etc. The specific attenuation requirements to be implemented throughout the proposed project buildings are provided in the Lambert Houses EIS, Table 15-5 (CEQR No. 16HPD001X), April 2016 for each development site included in the proposed project."*

In addition, the building mechanical system (i.e., heating, ventilation, and air conditioning systems) would be designed to meet all applicable noise regulations (i.e., Subchapter 5, §24-227 of the New York City Noise Control Code and the New York City Department of Buildings Code) and to avoid producing levels that would result in any significant increase in ambient noise levels. ✷